



FDOT: Coatings 101 How are Structural Coatings Specified in FDOT Projects?

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Who am I and what do I do?

- Paul Vinik, P.E. – State Structural Materials Engineer
 - 10+ years with FDOT at SMO
 - BSChE, MSChE: University of South Florida
 - SSPC C1/C2/C3/BCI L2 Coatings Inspector
 - Responsible for the FDOT Structural Materials Program including:
 - Source approval (steel, precast, prestressed, timber)
 - Chemistry, Corrosion, and Physical Laboratories

What are the governing contract documents?

Curriculum:

SSRBC-

Section 400: Concrete Structures

Section 560: Coating New Structural Steel

Section 561: Coating Existing Structural Steel

Section 562: Repair of Galvanized Surfaces

Section 563: Anti-graffiti Coatings

Section 975: Structural Coating Materials

Section 400: Concrete Structures

- **400-15.2.6 Class 5 Applied Finish Coating:**
 - Must be APL
 - No profile requirement but contractor must fill voids > ¼ inch
 - Apply the finished coating at a rate of 50, plus or minus 10 square feet per gallon.

Section 400: Concrete Structures (cont.)

Class 5 coatings Usage – aesthetic only

CONCRETE SURFACE FINISH POLICY

Required Concrete Surface Finish Decision Table

TYPE STRUCTURAL COMPONENT		REQUIRED CONCRETE SURFACE FINISH	
		URBAN	RURAL
Non-Special Bridges/Projects	Bridge column, cap, traffic railing, parapet, deck coping and underside	General surface finish or a texture as specified in SSRBC 400-15 ⁽¹⁾	General surface finish or a texture ⁽¹⁾
	Retaining wall	General surface finish or a texture ⁽¹⁾	General surface finish or a texture ⁽¹⁾
	Noise wall	General surface finish or a texture ⁽¹⁾	General surface finish or a texture ⁽¹⁾
Special Bridges/Projects ⁽⁴⁾	Inside and top surfaces of bridge and retaining wall traffic railings and parapets	General surface finish ⁽¹⁾	General surface finish ⁽¹⁾
	Bridge column, cap, and back of traffic railing and parapet	Surface finish at the discretion of the EOR with District Design Engineer (DDE) approval	Surface finish at the discretion of the EOR with DDE approval
	Retaining wall	Surface finish at the discretion of the EOR with DDE approval	Surface finish at the discretion of the EOR with DDE approval
	Noise wall	Surface finish at the discretion of the EOR with DDE approval	Surface finish at the discretion of the EOR with DDE approval only after Chief Engineer approval
Roadway barriers – all surfaces		General surface finish ^{(1) (2)}	General surface finish ^{(1) (2)}

(1) Exceptions allowing the use of coatings, tints or stains require approval of the Chief Engineer

(2) Coatings, tints or stains may be applied to roadway barriers in order to be compatible with Special Bridge treatments or corridor uniformity when warranted and approved by the DDE

(3) To enhance visual uniformity and at the discretion of the DDE, coatings, tints or stains may be applied to retaining walls and bridges that are in the visual proximity of noise walls that are coated, tinted or stained

(4) Bridges/Projects may only be designated as Special by the District Secretary or DDE depending on the situation

Section 560: Coating New Steel

- What is new steel?
Girders and bridge elements manufactured in a fabrication facility.
- Section 560 is riddled with references to the manufacturers published product data sheet.
Why do we rely on the manufacturer's PDS?
- Section 560 is set up in order of the **normal sequence** of painting operations, i.e. surface preparation, then application of coatings.

So what is the *normal sequence*?

- 1) Washing.
- 2) Abrasive blast cleaning.
- 3) Application of coatings.
- 4) Curing.

Section 560: Coating New Steel

Materials:

- All coatings must be on the Approved Products List (except Al Epoxy Mastic – Eng. Appv.)
- All thinners and solvents must be listed on the Manufacturer's published product data sheet.

Section 560: Coating New Steel

Materials Continued:

- Caulk must be deemed compatible in writing by the coating manufacturer.
- Abrasives are chosen by the contractor, but must meet the requirements of the Society of Protective Coatings (SSPC) AB1, AB2, or AB3 (ferrous, non-ferrous, mineral and slag abrasives)
- Coating application equipment is chosen by the contractor but must meet the requirements of the coating *manufacturer's published product data sheet*.

Section 560: Coating New Steel

EPA or OSHA?

- Containment for abrasive blast operations?
- Blood tests for poisonous heavy metals.
- Fall protection?
- Hard hats?
- Air monitoring equipment?
- Scaffolding Compliance?
- Pre and post job soil sampling?
- Air monitoring?

Who is responsible for OSHA and EPA compliance?

Section 560: Coating New Steel

Contractor Quality Control and Personnel Qualification Requirements:

- Contractor must provide all corporate and personnel qualifications along with a site specific coating plan at least 14 days prior to starting work.
- Shop painters must be SSPC QP3 or American Institute of Steel Construction (AISC) certified.

Section 560: Coating New Steel

Contractor Quality Control and Personnel Qualification Requirements Continued:

- Painters must
- Field be SSPC QP1 (field) and QP2 (lead removal) certified as appropriate.
- All QC inspections must be performed by personnel who are either SSPC BCI L1 or NACE L1 certified throughout the contract
- QC personnel must report to a QC manager who is SSPC BCI L2 or NACE L3.

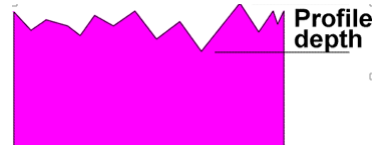
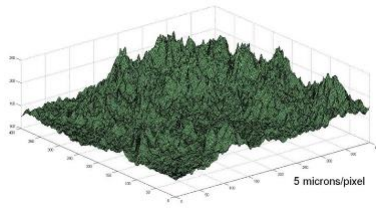
Surface Preparation: SSPC SP-10

- Erect the appropriate containment:
 - **Normally** Class 2W or 2A per SSPC Guide 6:
 - Class 2A: abrasive blast cleaning, utilizes air-impenetrable walls, ceiling, and floors, as applicable, with rigid or flexible framing, fully sealed joints, partially sealed entryways, negative air pressure achieved by forced or natural air flow (verified visually) and exhaust air filtration.
 - Class 2W: Wet methods of preparation, requires water-impermeable walls, ceiling, and floors, as applicable, rigid or flexible framing, fully sealed joints, overlapping entryways, and natural air flow.

Surface Preparation: SSPC SP-10

- Pressure wash: Clean all debris, dirt, grease etc. from structure
 - SSPC SP1
- Perform soluble salt testing
 - 70 uS/cm²???
- Abrasive blast providing an anchor profile compliant with the manufacturers published product data sheet and an SSPC SP10 near white blast level of cleanliness.

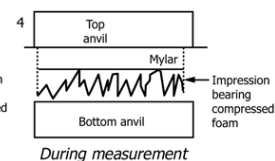
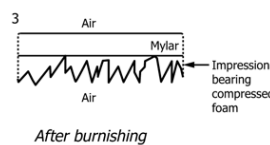
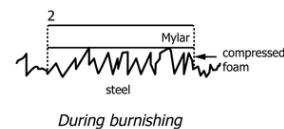
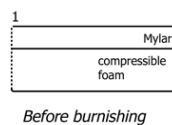
Whoa! What is an anchor profile?



Anchor profile is required to ensure that the coating has good adherence to the steel. Without a profile tensile strengths would be greatly reduced because there are no irregular surfaces for the coating to “grab” onto.

How do you measure Anchor Profile?

- ASTM D4417
 - Method A: Replica tape:



How do you measure Anchor Profile?

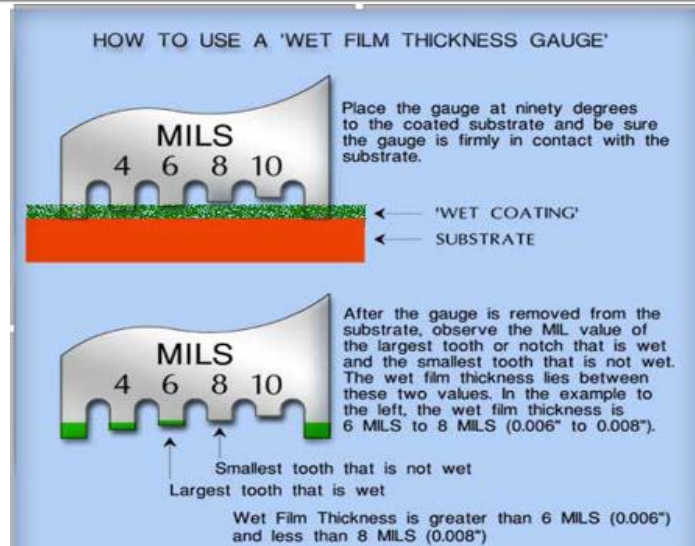
- ASTM D4417
 - Method B: Depth Micrometer with fitted probe



Application

- *Coatings must be applied in compliance with the manufacturer's published technical product data sheet.*
 - *Thinning*
 - *What is DFT and WFT?*
 - *Environmental and curing for recoat*
 - *Brush, roller, or spray or all?*

Wet Film Thickness



Dry Film Thickness



How is DFT related to WFT

$$WFT = \frac{DFT}{\% \text{ solids (volume)}}$$

OK, but contractor thins the paint.....

$$WFT = \frac{DFT}{\left\{ \frac{\% \text{ solids (volume)}}{100\% + \text{Thinner}} \right\}}$$

Application: what if?

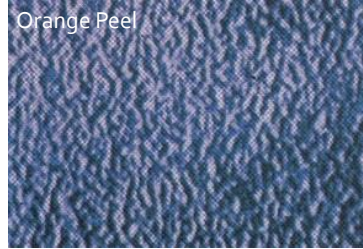
- If the anchor profile is measured at 3 mils and the DFT is measured per SSPC PA2 at 2 mils.... **Is there a problem here?**
- No. DFT is the coating film thickness above the profile. So in this case there would be 2 mils of coating above the anchor profile.
- Well Maybe, what profile & DFT is required?

What is a Defect?

Sags



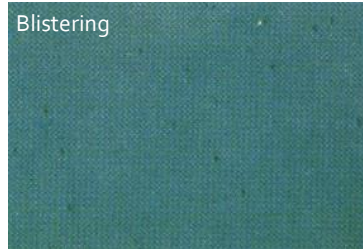
Orange Peel



Overspray

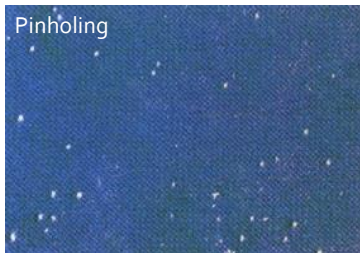


Blistering

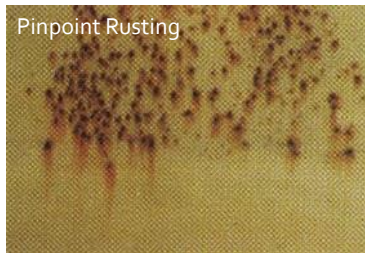


What is a Defect?

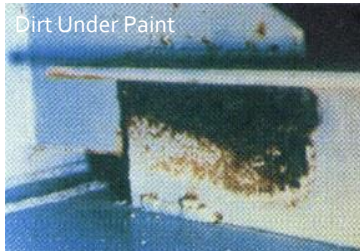
Pinholing



Pinpoint Rusting



Dirt Under Paint



Crackling



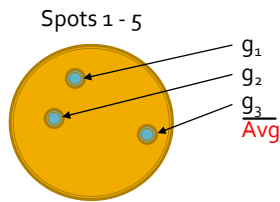
SSPC PA2: Definitions

- **Gage Reading**: A single instrument reading.
- **Spot Measurement**: The average of three, or at least three gage readings made within a 4-cm (approximately [~]1.5- inch) diameter circle.
- **Area Measurement**: The average of five spot measurements obtained over each 10 m² (~100 ft²) area of coated surface, or portion thereof.

SSPC PA2: How its done

- For areas of coating **greater than 300 ft² and not exceeding 1,000 ft²**, arbitrarily select and measure three 100 ft² areas.
- For areas of **coating exceeding 1,000 ft²**, arbitrarily select and measure the first 1,000 ft² as above. For each additional 1,000 ft² coated area (or increment thereof), arbitrarily select and measure one additional 100 ft² area.

SSPC PA2: How its done



- No individual spot measurement can be less than 80% of the specified DFT
- No individual spot measurement can be more than 120% of the specified DFT

For 5000ft² of coating area: 3 spot measurements in first 1000 ft² + 4 additional spot measurements for remaining area = Total of 7 spot measurements

Fickian diffusion through films:

X = film thickness

$J = Dp * \frac{\Delta C}{\Delta X}$

$\frac{J_1}{J_2} = \frac{D_{p1}}{D_{p2}} * \frac{(\frac{\Delta C_1}{\Delta X_1})}{(\frac{\Delta C_2}{\Delta X_2})}$

Flux		Diff Coef		Conc Gradient
J	=	D _p	*	$\Delta C / \Delta X$
mol/m ² *s		mol/s		(mol/m ³)/m

D _{p1}	D _{p2}				
1.00E-08	1.00E-11				
J ₁ /J ₂ =	1000			Assume X ₂ = X ₁	
If paint 1 is 3 times thicker than paint 2:				Assume X ₁ = 3*X ₂	
J ₁ /J ₂ =	333				

The Tools of the Trade



Thank you for this opportunity!

*If you have any additional
Questions?*

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